

No. 56.]

Metropolitan Sewers.

ON TRAPPING OF GULLIES.

AMONG the evils which have resulted from the faulty construction of sewers, none have been more obvious than the constant deterioration of health to which persons living near the gratings of the gullies have been exposed. But however numerous or fatal the attacks of typhus, of scarlet fever, or other similar diseases may have been in such situations, since they cannot be certainly traced solely to this cause of locality, it need not be contended that more mischief has arisen than that which is evident to the passer-by, so that he who runs may observe it. That a miasmatic and disagreeable odour—producing nausea, headache, and a general tendency to debility—escapes at uncertain, yet frequent periods, from the communications between the sewers and the streets above them.

This fact is commonly referred to the foul state of the sewers below; but it does not warrant any such general inference, nor would the evil be removed by the most accurate cleansing of the sewers in the immediate vicinity of such gratings, because these unhealthy emanations may result from several different causes. After sunset and before sunrise, especially in summer, it occasionally happens that the air within the sewers is considerably warmer than the external atmosphere. In such cases the warmer air ascends rapidly from some gratings, while it is replaced by colder air descending into others, the respective localities of ascent and descent being determined by several variable causes, such as the previous direction of the wind, the difference of level of the fluid, or the comparative evolution of the gases in the immediate vicinity. The foul and warmer air thus arising may occasionally be seen at some distance, assuming by its condensation, when coming in contact with the cold air, the appearance of a little cloud or steam overhanging the grating.

In many parts of the metropolis the gratings are also within reach of the tidal influence of a gradually heightened level, as the stream of flood rises, which forces

some of the air before it; and as the contrary effect takes place on the ebb, the result is, that the gases drawn upwards or downwards, with the current from higher or lower levels, are disgorged in these situations, giving an erroneous impression of the filthiness of the sewers nearest to the outlets which are so offensive. Examples of this kind may frequently be observed in the neighbourhood of the Strand, where the sewer itself does not stand in need of cleansing, as well as in the upper parts of the town.

But the general and unavoidable cause of the ascent of deleterious vapours from the sewers appears to be barometrical, and independent of any change of temperature. Other causes may force out the gases already developed, but this cause sets them free when in a state of solution, and thus, as the effect arises from the unavoidable presence of decomposing matters under a law analogous to that of the production of yeast in the vinous fermentation, it can never be prevented, although we may guard against its results. Assuming that the barometrical pressure is such that a mass of liquid holding in solution the different varieties of hydrogen, of ammonia, or of other gaseous compounds, has no tendency to give them off, it is obvious that a decrease of barometrical pressure may be compared to the removal of the cork from a bottle of soda water. The pressures above and below tend rapidly to become equalized, and much of the gas before in solution will be set free. Thus the common and true observation is, that the drains smell most strongly before heavy rains, or rather while the barometer is falling rapidly.

It is evident that this evil must continue to exist wherever sewers have a free communication with the air, and it would appear probable, from what has been already stated, that no carefulness or perseverance in cleansing can do more than diminish, without entirely preventing its recurrence. It is to be hoped, indeed, that the use of impermeable drains may at length produce an effectual remedy, but it yet remains to be seen how far the escape of the gases arising from decomposition can be prevented by such means. We know, however, that some time must elapse before much progress can be made in the substitution of pipes, even for the collateral sewers, to any great extent. We shall be aware also, that should a separation of the house-drainage take place by laying pipes within the existing sewers, while they still continue to transmit the storm waters, some ventilation will always be required, while the production of noxious gases from the previously saturated surfaces would for some time scarcely be diminished, because the saturation of these structures with the products of decomposing substances has been so complete, and so long continued, that probably many years would elapse before the surrounding air would carry off no odour disagreeable to the sense.

With regard to the larger or valley lines of drainage, such measures may for the present at least be considered as impracticable; and therefore we must look forward to so long a period, during which the evolution of noxious gases from those sewers cannot be prevented, that some means of palliation seems to be very urgently demanded.

A chemical analysis is, perhaps, in such a case scarcely applicable, because we have no means of knowing whether the tests have been applied to such a compound as ordinarily occurs in the sewers, without any subsequent dilution or casual alteration, which might be due merely to the lapse of time or to other causes, such as increase or diminution of temperature.

The sense of smell, however, which detects the general uniformity of these nauseous vapours, may suffice to lead us to the conclusion that sulphuretted hydrogen forms a considerable portion of them, while the rapid destruction of white paint in the vicinity of such outlets as the gratings in question will lead to the same conviction.

As some per-centage also of the gas which escapes from the pipes of the various companies must necessarily be found in the sewers, this circumstance concurs with others to render it extremely desirable that the combustion of a furnace having a strong draught should be resorted to as one temporary means of destroying the noxious air, in situations where its escape from the sewers is especially complained of.

Whether much advantage to the air remaining within the sewers may hereafter be obtained by connecting the draught of furnaces with them, must necessarily depend upon the willingness of their owners in general to allow such connections to be made. If furnished with a valve to prevent the egress of air during the night, or at times when the fires were out, no inconvenience could result, while even if the combustion of the gases were imperfect a great velocity of discharge would be thus produced, and in the Borough especially, where the required shafts abound, a very great amelioration of the present nuisance might be very cheaply obtained by these means, if the proprietors of furnaces would co-operate in their use.

As to the modification of those gases which are incombustible, by passing them through the fire, it would seem that the analogy of the purification of infected clothes, in a far lower heat, may sufficiently lead to an inference that the miasma produced by the putrefactive process of the sewers would be thus rendered innoxious to health. It may also be observed that we have only to deal with the lighter gases in trapping gullies. Those which are heavier, as in the case of carbonic acid, would still be carried downwards by the stream without escaping at the higher apertures.

It seems, however, necessary that a more general relief from this evil should be obtained, selecting in the first instance those localities which have been found to be especially subject to this defect, and afterwards extending it to the vicinity of the valley lines, or to places where any local circumstances may render the introduction of pipes comparatively difficult or inexpedient.

The vast number of open gratings to the gullies which at present exist throughout the metropolis contain individually an area of one foot superficial exit; and if we estimate the velocity of draught upwards to be no more than six inches a second, or thirty feet in a minute, we shall certainly underrate it. Yet, on the supposition that 5,000 such gullies give out their contents simultaneously, and more than this must occur previous to a change of weather, we shall

1000 ft to house 1/3 mile

have $30 \times 5,000$, or 150,000 for one minute, 9,000,000 for an hour, and no less than 216,000,000 of cubic feet of vitiated air disgorged during twenty-four hours. It must be considered that this air will, in the first instance, be all present in the aerial stratum nearest to the ground, and thus it may be defined as sufficient to occupy a space of upwards of 24,000,000 of yards, with a depth of one foot, or, in round numbers, an area of upwards of 4,000 acres.

It is thus evident that, in cases where the stillness of the atmosphere tends to check the rapidity of circulation by which the vitiated air is diluted, the whole atmosphere of the metropolis may be very seriously deteriorated from this single cause, although no marked effect may be perceptible, except in very confined localities, such as courts and alleys.

It is therefore probable that any future modification of the sewerage would still, in some degree, require the protection given by trapping, in order to keep the streets free from noxious gases, especially as the escape of hydrogen from the gas-pipes, and drainage into the sewers, from the superincumbent strata, of water containing that gas in solution, would still continue.

If it should prove that we are required to give to a tubular drainage occasional stand pipes, open, in order to avoid the loss of the barometric pressure for a hydrostatical balance sufficient for free discharge, this object cannot be obtained without some liability to the evolvment of the lighter gases; so that on this account also it would still be advisable that the gullies should be effectually trapped.

In ordinary cases, it would be prudent to allow for every gully which is trapped one 6-inch or two 4-inch pipes, by which a discharge of air may be kept up. They should be carried from the crown of the sewer, slightly above the level of the chimneys, and kept far enough apart from their apertures to guard against the liability of contaminating the downward current which occurs at night, or when fires are not used.

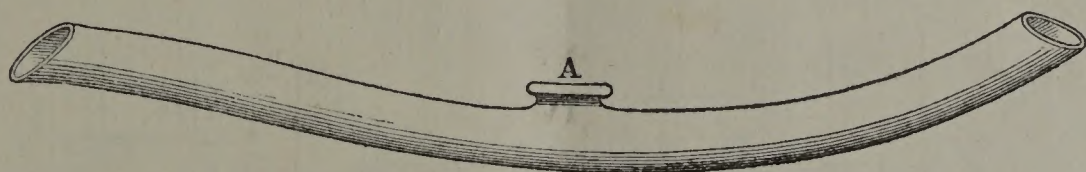
For this purpose the pipes already attached to many houses for the drainage of the rain water from their roofs might also be adapted, by adding to them, as a branch, the additional length required, and placing a syphon trap above the branch. In dry weather it might probably be necessary to pour water into these syphons; but an inconvenience which admits of so easy a remedy will at least be preferable to that which exists at present.

The flaps by which the gullies are ordinarily trapped are not always sufficient to prevent the passage of air, as the intervention of small portions of refuse will occasionally prevent their action. A syphon may therefore be made use of in the gully itself. It may be either of cast-iron pipe, or of earthenware when obtainable, six inches in diameter, and should have a length of six feet, in order to give a sufficient area to bear ordinary evaporation, as well as to render the curvature sufficiently easy. It should also have a perpendicular branch in the centre, extending upwards, above the surrounding work, so that a force may easily be applied to clear it from any accidental obstruction. This length of curvature may be obtained by inclining the drain in both

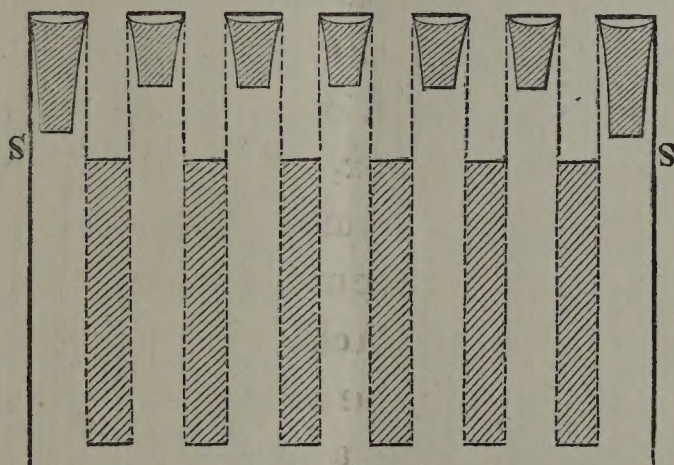
directions from the perpendicular, so as to gain about three feet laterally on each side; and the quantity of water thus ensured will, probably, never become saturated with the gases, so as to transmit them.

If the house-drains be themselves sufficiently trapped, it is probable that no farther inconvenience will be found from the sewers; and although currents of air will by this plan be attracted into those houses the communications of which are faulty or unattended to, yet, as a remedy will always be within the reach of their proprietors, it does not appear that this objection ought to be allowed to interfere with the execution of works, which, like those now proposed, are necessary for the convenience, the comfort, and the health of the public in general.

Some syphons of this description, as represented in the sketch A, have been



prepared as a trial work for trapping two of those gullies which have been particularly complained of. In order to avoid the expense of an entire alteration of the gully gratings, sand traps of the kind represented in the sketch B, where the lines shaded darkly represent the sections of the bars of the gully grating, and the



dotted lines give the form of the narrow boxes so fitted as to slip in between the bars, and thus to diminish the area of their openings. These oblong receptacles being closed at the ends as high as s s, but open above, would leave only an opening equivalent to 36 inches instead of 144 in area; and thus, with the same amount of current, three-fourths of the passing air would be arrested in its progress upwards. Should the action of this species of trap prove to be effective, the time and labour requisite for keeping them clear would necessarily be less, and less expensive than the removal of the same amount of refuse from the level of the sewer, whether by flushing or any other means; and it is probable that if the use of traps of this or

any similar construction can be extensively resorted to, much of the expense of flushing might be saved, because the lighter materials themselves have not the same tendency to form obstructions which require labour to remove them, as the mass which is formed by the mingling of calcareous substances with the other refuse which has at present an uninterrupted entrance at the grating.

EDWARD MURRAY.

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